

Section 5

Water and Wastewater Infrastructure

INTRODUCTION

Water and wastewater infrastructure for the White Hills property is discussed herein. The section is organized as follows:

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WATER SYSTEM INFRASTRUCTURE (including Water Supply and Demand)

Project Background

The project, located in Mohave County encompasses approximately 2900 acres in sections 16, 17, 19, 20, 21, 23 and 30 of Township 27 N., Range 20 W., of the Gila and Salt River Base and Meridian. A total of approximately 3500 acres in the area is owned by Rhodes Homes. The existing water system infrastructure, which consists primarily of small capacity wells, is inadequate to support a municipal type water supply system. There is no community water system within the area that could adequately serve the project. This will require that a complete water system including water source, storage and distribution be developed for the project.

Currently there are no water wells registered with the Arizona Department of Water Resources (ADWR) within the White Hills Property. There are two existing wells located in Section 15 which is adjacent to the project. In addition, two test wells are currently being developed within the property. As there has been no historic need to drill and equip a well for the quantities required of a master planned community within the boundaries of the White Hills project, a definitive conclusion as to groundwater quantity and quality adequate to support the planned project can not be made. Stanley Consultants, however believes that regional data indicates that it is feasible to develop the groundwater resources in the area in order to service the project (the initial phases at a minimum) with a municipal type water supply.

The project lies within the Detrital Valley Aquifer Basin and hydrogeological investigations are currently underway to determine the aquifers ability to supply a municipal water system. Errol L. Montgomery & Associates, Inc. is in the process of concluding a test well and ADWR filing program. The developer has applied for a determination of 100 year water adequacy with the Arizona Department of Water Resources.

Water System Assumptions

The following assumptions have been made to determine water system demands, treatment alternatives, and distribution system needs:

- 1. Average water usage rate = 150 gpcd.

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2. Average number of people per household = 3.0 (assumes single family residences) and in accordance with Table 5.1, "White Hills – Water Demand Spreadsheet".
3. Average number of dwelling units per acre = 7.4 for the entire project.
4. Peaking factors are 2.0 for peak day and 3.5 for peak hour (Arizona American Water development standard).
5. Pressure zones are defined as having low pressure of 40 psi and high pressure of 90 psi.
6. Average well production rate is 500 gallons per minute.
7. Groundwater supply must meet maximum day demand with the largest producing well in a system out of service. Peak hour and Fire Flow demands will be met with system storage. As the project progresses, additional water system sizing alternatives will be evaluated and it is possible that additional storage capacity could be used to reduce the amount of firm groundwater supply.
8. Distribution pumping is sized for peak demands with the largest pump out of service.
9. Storage capacity is sized for the larger of the two of either a) twice the amount of peak hour demand above max day for six hours or b) three hours of fire flow plus the amount of peak hour demand above maximum day for six hours. Fire flows are 1500 gpm for 3 hours at each storage facility. Note commercial zone fire flows could be higher.

Source Water

The primary source water for this development will be groundwater from the Detrital Valley basin. Surface water could possibly be obtained by either purchasing or leasing a surface water right from an owner. A brief discussion of the options follows below.

Groundwater. The Detrital Valley basin encompasses approximately 875 square miles. The basin is bounded by the White Hills and Cerbat Mountains to the east, the Black Mountains to the west, and a low topographic rise to the south that separates it from the adjacent Sacramento Valley basin. The valley floor slopes northward from 3,400 feet to 1,200 feet above mean sea level where Detrital Wash drains into Lake Mead. Maximum altitude in the basin is 7,148 above mean sea level in the Cerbat Mountains.

Groundwater occurs mostly in the basin-fill material and at shallow depths in the alluvial deposits along the mountain washes. Groundwater flows in a northerly direction with depth to groundwater ranging from 20 feet at Lake Mead to over 780 feet below land surface at the south end of the basin. Depth to bedrock exceeds 6,000 feet below land surface at its deepest point. Well yields of up to several hundred gallons per minute have been reported in the basin-fill.

There is an estimated 1.0 million acre-feet of groundwater in storage in the Detrital Valley basin with less than 1,000 acre-feet recharged annually. Most of the 190 acre-feet pumped in 1985 were used for domestic purposes. Historical groundwater data is limited; however, little change in water levels suggests the basin is in a steady-state condition. Most of the groundwater is of suitable quality for domestic and other purposes with only isolated areas containing high dissolved solids and fluoride concentrations.

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A search for available ADWR well records was conducted by Stanley Consultants. The search indicated two records of wells within the site area. These were located in the northeast quarter of Section 15, and the southeast quarter of Section 21. The file information for the Section 15 well indicated a well depth of approximately 800 feet. The files indicated a total of 26 well records within Township 27N, Range 20W.

A search of available US Geological Survey records for the site area was conducted by Stanley Consultants. This information indicated an additional four wells in the general site area (within approximately one mile of the site). The depths reported for these wells varied up to 500 feet, with depth to groundwater of approximately 400 feet. It is likely there are other smaller wells in the site area as well that do not appear in the records.

Based on the initial research it appears feasible that there are sufficient amounts of physical groundwater available to support the project. It is Stanley Consultants recommendation, however, to confirm the "regulatory availability of this resource" with proper ADWR and Mojave County officials. Also, further hydrogeological studies will be required to prove out the groundwater resource in detail.

Surface Water. Water rights available from Indian tribes or other Colorado River "Main Stem" water rights holders may be available as a means to insure long-term water supply for the development.

It is noted here that using surface water for the development will be costly. The water must be transported to the site and treated via a complete water treatment plant, which includes a filtration system. For these reasons and in the absence of any identified surface water rights with a "place-of-use" near the project, ground water development appears to be the most feasible source of municipal supply. This determination is based on Stanley's understanding that the White Hills area is not currently within an Arizona Active Management Area (AMA). Within some Arizona AMAs, there is a requirement that a water system must meet the "safe yield" provisions of Arizona statute by 2025. This provision means that any water system within the AMA must prove that the water withdrawn from an aquifer is replaced by water from another source such that there is no net loss of water from the aquifer. If Arizona were to, at any time, declare the White Hills area an AMA, then the development would have to meet the "Safe yield" provisions set up for the White Hills AMA and surface water sources may be required to maintain the development's sustainability.

It is also noteworthy that Mohave County statutes require a letter of "Water Adequacy" from ADWR prior to offering homes for sale.

Basic source of supply system requirements. Table 5.1 provides a general overview of the water supply requirements of the system. For the development, an average daily production of 8.9 mgd (10,000 AF/YR) is required. With average well

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Table 5-1 – White Hills Projected Water Demands

Zone	Section	Township	Range	Land Use	Acres	Water Demand					
						Use Rate (1)	per/DU	DU/acre	use, gpd	use, max day	use, peak hr.
1	17,19,20,30	27N	20W	residential	843	150	3	7.4	2,807,190	5,614,380	9,825,165
2	20,16,21	27N	20W	residential	1250	150	3	7.4	4,162,500	8,325,000	14,568,750
3	16,23	27N	20W	residential	316	150	3	7.4	1,052,280	2,104,560	3,682,980
4	23	27N	20W	residential	256	150	3	7.4	852,480	1,704,960	2,983,680
5-10 Upper Zones	23	27N	20W	residential	222	150	3	7.4	33,300	66,600	116,550

8,907,750 17,815,500 31,177,125

Storage Requirements

Reservoir Volume Based on the Larger of the Following Criteria:

1. $V = 2 * (\text{Peak Hour Demand} - \text{Max Day Demand}) * 6 \text{ Hours}$
2. $V = (\text{Peak Hour Demand} - \text{Max Day Demand}) * 6 \text{ Hours} + \text{Fire Flow} * 3 \text{ Hours}$

**Volume Required
(gals)**

	Zone 1	Zone 2	Zone 3	Zone 4	Upper Zones
Equation #1	2,105,393	3,121,875	789,210	639,360	24,975
Equation #2	1,322,696	1,830,938	664,605	589,680	282,488

Pumping Requirements

						Total	Wells Required @400 gpm/well
Million Gallons per Day	5.61	8.32	2.10	1.70	0.06	17.79	
Gallons per Minute	3,896	5,778	1,458	1,181	42	12,354	25

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production estimated to be 500 gpm (0.72 mgd), the well field capacity is sized to provide average daily flow to the system, and assuming that the entire water distribution system of the project is interconnected, the development will require a minimum of 15 wells. Maximum day demands will be met through system storage. The wells are expected to be approximately 1500 feet in depth, have a 12" – 14" casing size, and range in horsepower from 150 to 300 hp. The wells are expected to be concentrated in the western ½ of the contiguous parcels; as we get closer to the mountains, available water may drop off dramatically (as well as water quality), which would require more wells to be drilled to meet demand. Stanley recommends that the developer perform well yield testing of existing wells along with the new test wells to determine aquifer characteristics. This will allow a more accurate determination of well yields in the White Hills area.

How to deal with non-contiguous parcels. For the non-contiguous parcel in Section 23 utility service would be supplied through the roadway that would provide access to the main development. The developer could also explore the possibility of a well field within Section 23. Should BLM easements be required to connect the system to Section 23, the developer plans to secure the necessary Right-of-Way.

Water Quality and Treatment.

Historically, Groundwater in Arizona requires little if any conventional treatment to be defined as potable. In the White Hills area, all potable water is pumped from deep groundwater wells. The two existing wells average approximately 800 feet in depth. Municipalities annually test water for contaminants. Typically ground water requires a small amount of chlorine to provide disinfection in the distribution system. A disinfection method for groundwater is now required under the newly promulgated groundwater rule.

The water quality of the Detrital Valley basin is relatively good. Dissolved minerals (measured in total by Total Dissolved Solids) are the most consistent concern, but this is typical of Arizona water. Fluoride, Arsenic and Radon levels may require treatment. At this time, future regulations for groundwater (Aldicarb, Total Coliform, Stage 2 Disinfectants/Disinfectant byproducts) will require increased sampling.

Stanley has, as a part of this work effort, prepared a Phase 1 environmental site assessment of the area.

Treatment of surface water typically is achieved by conventional treatment methods (rapid mix with chemical addition, flocculation, sedimentation, filtration and disinfection) or, more recently, by the use of microfiltration systems that preclude the use of many conventional treatment elements. As groundwater is assumed to be the source of supply for the development, this topic will not be discussed in detail.

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Water Distribution and Storage Layout.

A conceptual backbone water distribution and storage system layout is shown in Figure 5-1.

The system attempts to make the best use of gravity in the distribution system layout. To determine the pipe size for each section, the demands for each section were calculated and, using standard velocities and "steady state" pressure gradients, the pipes were sized. Pipes are sized for "pass through" of the whole development, using pressure reducing valves (PRVs) to move water from one pressure zone down gradient to the next. Zones 5-10 (Upper Zones) are designed with a single storage location and PRV stations will be used to control pressure to each zone. As design progresses additional alternatives will be considered and the system will be computer modeled.

Ownership of the Water System.

There are two primary ownership alternatives for the water system. They are as follows:

1. The developer contracts with a private company or district to own and operate the water system.
2. The developer forms their own company to own the system.

Private Company Ownership. The developer may decide to negotiate with a private water company to take ownership of the system. Liability of the system is removed from the developer and there may be more flexibility and control available to the developer based on the deal that is negotiated. Typically, the developer negotiates with a private company to keep control of infrastructure's construction to some point so the developer can control the pace of development and better control costs. Infrastructure cost sharing is often a component of these agreements (company would reimburse developer for capital expenditures the developer incurs and vice versa), so the developer may see some "time value of money" savings. Once construction of facilities is completed, ownership of the facilities can be turned over to the private company, at which point the liability for system performance also shifts to the private company. The developer would maintain liability for their constructed product. The private company will have to file a Certificate of Convenience and Necessity (CC&N) with the Arizona Corporation Commission (ACC); this is a time-consuming effort, and may impact schedule if the process is not started early in the development process.

Arizona Statutes have a provision for special public water districts to be formed which could be beneficial for the proposed project. Such a district would be a quasi-governmental agency and would require extensive legal and political effort to establish.

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Developer incorporates own water company. The developer may decide to form their own water utility company. This alternative involves the most paperwork and regulatory involvement (and leaves all of the liability for the system on the developer), but offers the developer the most flexibility in determining the course of action they can take. Once the company is formed, the developer can choose to negotiate system ownership or operations and maintenance deals with private companies to find the best arrangement. They also can maintain total control over the system if they cannot strike a favorable deal with these entities. The developer will have to file a Certificate of Convenience and Necessity (CC&N) with the Arizona Corporation Commission (ACC); this is a time-consuming effort, and may impact schedule if the process is not started early in the development process.

WASTEWATER SYSTEM INFRASTRUCTURE

Project Background.

There is currently no wastewater collection system within the limits of the White Hills Property. All properties in the surrounding area are served by small septic systems.

Sewer System Assumptions.

The following assumptions have been made to determine wastewater system demands, treatment alternatives, and disposal alternatives:

1. Average wastewater generation rate = 80 gpcd.
2. Average number of people per household = 3.0 (assumes single family residences) and in accordance with Table 5-2, "White Hills – Sewer Demand Spreadsheet".
3. Average number of dwelling units per acre = 7.4 for the entire project.
4. Peaking factors are 1.3 for maximum month, 2.0 for peak day and 3.0 for peak hour flow (Arizona American Water development standard).
5. A small package plant may be required until wastewater flows justify construction of a complete wastewater treatment facility.
6. Treatment alternatives must be able to produce reuse-quality effluent for all Phases.

These assumptions are based on Stanley's understanding that the developer is creating a "destination development" that goes beyond the minimum standards for wastewater works currently in place in Mohave County and at ADEQ. As such, widespread use of septic systems and small capacity "package" wastewater plants are not expected to be a part of the development.

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Table 5-2 - White Hills Project Sewer Demands

Connection Point	Section	Township	Range	Land Use	Contributing Acres	Sewer Demand				Peak Hour Ave x 3
						Use Rate (1)	per/DU	DU/acre	Ave gpd	
1	23	27N	20W	residential	213	80	3	7.4	378288	1134864
2	23	27N	20W	residential	640	80	3	7.4	1136640	3409920
3	21	27N	20W	residential	912	80	3	7.4	1619712	4859136
4	20	27N	20W	residential	1475	80	3	7.4	2619600	7858800
5	20	27N	20W	residential	1885	80	3	7.4	3347760	10043280
6	19	27N	20W	residential	2434	80	3	7.4	4322784	12968352
7	19	27N	20W	residential	2755	80	3	7.4	4892880	14678640
8	30	27N	20W	residential	2887	80	3	7.4	5127312	15381936

See Map for Connection Point Location
(1) 80 Gals/day/person

Ave Day Demand 5127312
Peak Day Demand 10254624
Peak Hour Demand 15381936

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Wastewater Collection.

The backbone wastewater collection system is shown in Figure 5-2. The collection system assumes gravity flow from east to west is attainable for the whole White Hills project with the exception of portions of Sections 16 and 23, where low-head lift stations may be required to move flows across a wash to the gravity system. To determine the pipe size for each pipe section, the demands for each section were calculated and standard pipe slopes and velocities were used. Flow is additive from section to section, moving east to west. Minimum sewer collection main size is 8". Trunk sewer line sizes range from 8 inches in the eastern portions to 30 inches at the western terminus.

Total average daily wastewater demand is calculated to be approximately 5.65 mgd.

Wastewater Treatment.

Having assumed that the development will utilize class A+ reclaimed water, the wastewater treatment alternatives are limited to that which can produce this type of effluent. The general process units include solids screening and removal, clarification, biological treatment for removal of nutrients, filtration, and disinfection. These processes can be achieved by both "package" plants (on a temporary basis) and "permanent" plants, so combinations of treatment alternatives can be utilized to optimize the cash flow for wastewater infrastructure.

The location of a wastewater treatment plant is generally the lowest geographic point in the service area. This typically minimizes collection system costs. This requires the treatment plant to be located at the western edge of the development near Highway 93.

For the White Hills project, there are several alternatives for wastewater treatment available to the owner. These include the following:

1. Building a WWTP to treat wastewater from the development.
2. Using individual septic systems.
3. Finding a combination of these alternatives that best suits the development phases of the project.

Build a WWTP to treat wastewater from the development. The developer may choose to build a WWTP to treat the development's wastewater. Locating the plant in Section 25 along HWY 93, which is assumed to primarily be zoned for industrial or commercial due to proximity to the highway, would best serve the project. Reclaimed water pump stations will be required to deliver reclaimed water to the development.

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The plant phasing would be implemented based entirely on absorption rates of the White Hills property. A detailed study of this phasing is beyond the scope of this report. Stanley's experience indicates that startup plant sizes range from 0.5 mgd to 1.5 mgd. The first phase of construction would be most costly on a dollars per gallon basis, as all ancillary and support facilities, as well as much of the buried influent piping and lift station, must be constructed with long-term use in mind. Using 6.0 mgd as the plant capacity the site would vary from 8-15 acres in size, dependent on type of technology used to treat wastewater. This plant site, however does not include area that would be required for construction of sludge storage or effluent disposal, which could substantially increase the land require particularly if rapid infiltration is the chosen disposal option.

Use of Septic Systems. Mohave County Ordinances allow the use of septic systems, however due to the large number of projected housing units and small average lot size septic systems are not considered to be a viable option for this development.

Wastewater Disposal (Direct Discharge vs. Reuse).

Once sewage is treated in a WWTP, it has to be disposed of. The water can be discharged to a receiving stream, disposed of via infiltration systems, or it can be reclaimed directly for beneficial use. When determining the water balance for a development, in Arizona, there is what is colloquially called "paper water". In short, what this means is that direct discharge to a receiving stream or septic discharge cannot be used for recharge credits, even though much of the water from these discharges enters the ground and is eventually recharged into the aquifer. With this definition, most large-scale developments, particularly in established AMAs (or where local policies require extensive management of groundwater aquifers), have developed plans to reclaim the water to obtain recharge and reuse credits and improve the development's water balance. In active management areas (AMA's), this is a required practice. This parcel is currently not in an AMA, so the water balance is not required by State Statute. However, County planning policies indicate that advanced groundwater basin management practices, such as recharge and reuse programs to reduce groundwater depletion may be required. Furthermore, as the White Hills area develops, Arizona may create an AMA to encompass the area and this issue will need to be addressed. Also, the developer has expressed an interest in a reclaimed system as part of the allure of the property as a destination location.

While discharging to a receiving stream means that the development loses recharge credits that may be valuable to a development's water balance, it does save all the capital and O&M cost associated with construction of a reclaimed water system. Dependent on method of water reclamation (direct recharge facility or irrigation of golf courses, parks and street medians), implementation of a reclaimed water system can mean replenishment of the groundwater, withdrawal of less potable for irrigation or a combination of these benefits. A reclaimed water system can sustain development growth by decades because it extends the life of the groundwater resource.

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It may be beneficial to have a stream discharge permit in order to have discharge options should recharge or reuse systems develop problems or prove unreliable.

Ownership of the Wastewater System.

There are four primary ownership alternatives for the wastewater system. They are as follows:

1. The developer contracts with a private company or special district to own and operate the wastewater system.
2. The developer forms their own company to own the system.
3. The developer can enter into separate ownership scenarios for the treatment plant and the collection system.

Private Company Ownership. The developer may decide to negotiate with a private wastewater company to take ownership of the system. Liability for system operation is removed from the developer and there may be more flexibility and control available to the developer based on the deal that is negotiated. Typically, the developer negotiates with a private company to keep control of infrastructure construction to a point. This allows the developer to control the pace of development and better control costs. Infrastructure cost sharing is often a component of these agreements (company would reimburse developer for capital costs the developer incurs and vice versa), so the owner may see some "time value of money" savings. Once construction of facilities is completed, ownership of the facilities can be turned over to the private company, at which point the liability for system performance also shifts to the private company. The developer would maintain liability for their constructed product. The private company will have to file a Certificate of Convenience and Necessity (CC&N) with the Arizona Corporation Commission (ACC); this is a time-consuming effort, and may impact schedule if the process is not started early in the development process.

Arizona Statutes have a provision for special public wastewater districts to be formed, which could be beneficial for the proposed project. Such a district would be a quasi-governmental agency and would require extensive legal and political effort to establish.

Developer incorporates own wastewater company. The developer may decide to form their own wastewater utility company. This alternative involves the most paperwork and regulatory involvement (and leaves all of the liability for the system on the developer), but offers the developer the most flexibility in determining the course of action they can take. Once the company is formed, the developer can choose to negotiate system ownership or operations and maintenance deals with and private companies to find the best arrangement. They also can maintain total control over the system if they cannot strike a favorable deal with these entities. The developer will have to file a Certificate of Convenience and Necessity (CC&N) with

the Arizona Corporation Commission (ACC); this is a time-consuming effort, and may impact schedule if the process is not started early in the development process.

Developer enters into separate deals for treatment and collection systems. The developer may choose to negotiate separate contracts for collection of wastewater and treatment of wastewater. This could take one of two permutations, based on the potential ownership scenarios listed above. These permutations are listed below.

1. Private company owns treatment system; developer owned company owns collection system.
2. Private company owns collection system, developer owned company owns treatment system.

How to deal with non-contiguous land parcels.

Section 23 is the only non contiguous parcel and utility service will be extended to this section through the roadway, and appropriate easement that accesses the property. Separate systems could be considered for this section; however the cost to provide wastewater treatment in this area would exceed the cost of a connecting sewer.

RECLAIMED WATER SYSTEM INFRASTRUCTURE

Project Background.

It is Stanley's understanding that the White Hills will be developed with open space and parks (possibly golf course) that will make the development a "destination development". As such, the use of reclaimed water to maintain these amenities is an attractive alternative. Using reclaimed water to maintain these facilities reduces the amount of groundwater withdrawn from the local aquifer and provides a beneficial use for the wastewater generated from the development. The developer has expressed an interest in determining the feasibility of a reclaimed water system in this development.

Reclaimed Water System Assumptions.

The following assumptions have been made concerning the reclaimed water system.

1. Reclaimed water system infrastructure required for build out purposes will be built in all parcels to avoid tearing up relatively new roads 2-3 years into the development.
2. Effluent is assumed to be Class A+.

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Reclaimed Water Demand.

Popular uses of reclaimed water in destination developments include golf course watering and parkland green space watering. To maintain better control of the irrigation water supply, these facilities often construct lakes or other on-site storage facilities and the reclaimed water is supplied to these storage facilities. The land planning of the White Hills parcels is not to the stage of defining the quantity of green space that can be irrigated with reclaimed water, so an exact quantity of reclaimed water usage cannot be predicted at this time.

We can, however, gain an understanding of potential usage by looking at typical use rates of green space facilities. It is assumed (subject to verification with local climate and horticulture practices) that common green space areas - parks, roadway medians and golf courses - will be planted with Bermuda grass for summer growth and over seeded with Rye grass for winter growth. With the understanding that 1 acre-foot of water equals approximately 325,000 gallons and using typical use rates of 4.0 to 5.0 feet per year for Bermuda and 1.0-1.5 feet per year for Rye grass, we can estimate that green space in the White Hills parcels will consume reclaimed water at an annual average rate of 5 to 6.5 acre-feet per year per acre, or in the range of 1.6 to 2.2 million gallons per year per acre of green space.

As with potable water use, reclaimed water use peaks in the summer. Data obtained from a metro Phoenix golf course indicates an average daily reclaimed water use between 800,000 and 1,000,000 gallons per day. Summer irrigation use in White Hills is projected to be similar to Phoenix metro use rates. With average day wastewater flows of 6,000,000 gallons per day, the development can generate enough reclaimed water to irrigate several golf courses and have additional capacity for parkland or median irrigation. Approximately 9,000 to 13,000 gallons of water per day per acre of green space are required to maintain bermuda grass in the summer in Arizona. This means that with build out projections of 6,000,000 gallons of reclaimed water available per day, the development can sustain between 450 and 650 acres of green space. This would be the equivalent to support approximately 5 to 7 golf courses with reclaimed water only.

These demands will drop significantly in the winter, so an alternative method of disposal of reclaimed water is required. This is discussed in the wastewater section of this chapter.

Reclaimed Water Classifications.

Title 18, Chapter 11, Article 3 of the Arizona Administrative Code defines the various levels of reclaimed water in Arizona. In summary, the classes are A+, A, B+, B and C. Class A+ provides the developer with the greatest flexibility in reuse options. This report assumes that Class A+ effluent is desired by the developer. In order to achieve A+ effluent, a biological treatment process along with filtration and disinfection will be required. Class A+ effluent is defined as follows:

1. After filtration, prior to disinfection:
 - a. 24 hour average NTU (Turbidity) measurement less than 2
 - b. No NTU measurement greater than 5 at any time.
2. After disinfection, prior to entry into reclaimed water distribution system:
 - a. No fecal coliform in 4 of the last 7 daily samples.
 - b. No single fecal coliform sample greater than 32/100 ml.
 - c. 5 sample total Nitrogen, measured as a geometric mean, less than 10 mg/l.

Reclaimed Water Distribution and Storage Layout.

The reclaimed water system will require pumping from the wastewater treatment plant (WWTP) to the points of use. A storage reservoir and pumps will be required at the WWTP, (pumping from approximate elevation of 2400 to 3400). Storage reservoirs and pumps will be constructed at optimized locations or, if golf course lakes are available, inline pump stations may be used to move water directly to the lakes. Piping from the WWTP would be sized for build out use.

For golf course irrigation using reclaimed water, a commonly used strategy is to pump the reclaimed water to golf course lakes, then pump out of the lakes for irrigation. While this means the water gets pumped twice, the golf course gains two inherent advantages from having the lakes filled with reclaimed water: (1) they are not replacing evaporated and infiltration water with groundwater, thus preserving the groundwater resource, and (2) the golf course has an irrigation buffer in case of disruptions to the reclaimed water distribution system.

How to Deal with Non-Contiguous Land Parcels.

Section 23 would be provided utility service through the roadway and easements that would provide access from the main development.

Water and Wastewater Infrastructure System Costs

The following tables indicate an "order of magnitude" or "probable construction cost" cost estimate for water and wastewater infrastructure facilities. These estimates are based on the preliminary conceptual plans as shown on figures 5-1 and 5-2. They include basic capital costs for completing the basic infrastructure for the system. The estimates exclude any costs for water distribution or sewer collections systems within individual subdivisions or "villages". The estimates are intended to be used to evaluate the feasibility of the overall project. Subsequent master planning, conceptual and final design engineering services are required in order to obtain a reasonable level of precision for cost estimates for detailed planning or budgeting purposes.

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Water Supply:

The proposed system uses a system of new wells within the project site with strategic locations of reservoirs and transmission mains to take advantage of the site topography. Please note that the estimates are based on regional hydrogeological information that may or may not be valid for the project site.

Wastewater Collection and Treatment:

The wastewater system will include the need to process and dispose of the final solid waste (digested sludge) and the final disposal or reuse of the effluent. The effluent will require some ultimate disposal system, permitted by the State of Arizona, such as discharge to a water course or infiltration in recharge/infiltration basins. Additionally, summer weather would allow for reclamation of the effluent via the proposed system of reclamation pumps, pipes and storage facilities within the project site.

Reclaimed Water:

The overall plan for water and wastewater management includes reclaiming wastewater effluent and putting it to beneficial use for irrigation of large landscaped areas or golf course if ultimately included in the land plan. For feasibility purposes only, these cost estimates are based on using only two (2) effluent pump stations (somewhat limiting the availability of effluent to the eastern most parcels) and pipelines sized for a peak day flow of approximately 6 mgd (24 inch reducing to 12 inch).

CL01006

Rhodes Homes: White Hills
Preliminary Cost Estimate - Backbone

Description	Quantity	Unit	Unit Price	Total
Water				
Source/ Supply	25	well w/att	\$600,000	\$15,000,000
Storage & Pumping (0.3 MG/ 3.0 MG)	5	EA	\$1,600,000	\$8,000,000
Transmission Mains				
30"	13000	LF	\$125	\$1,625,000
24"	15000	LF	\$105	\$1,575,000
18"	18000	LF	\$90	\$1,620,000
12"	10000	LF	\$75	\$750,000
Water Total:				\$28,570,000

Sanitary				
6 MGD Treatment Plant	1	A+ Eff.	\$43,000,000	\$43,000,000
Lift Stations	2	EA	\$250,000	\$500,000
Trunk Lines				
30"	2000	LF	\$250	\$500,000
27"	4000	LF	\$225	\$900,000
24"	3000	LF	\$200	\$600,000
21"	6000	LF	\$160	\$960,000
18"	3000	LF	\$120	\$360,000
15"	9000	LF	\$70	\$630,000
12"	4000	LF	\$60	\$240,000
8"	10000	LF	\$45	\$450,000
Sanitary Total:				\$48,140,000

Notes: Cost Range for Plant is \$5 to \$8/gal.

Reclaimed Water				
Pump Station/Storage	2	EA	\$1,500,000	\$3,000,000
Force Mains				
24"	10000	LF	\$120	\$1,200,000
18"	6000	LF	\$105	\$630,000
16"	4000	LF	\$90	\$360,000
12"	5000	LF	\$75	\$375,000
Reclaimed Total:				\$5,565,000

Preliminary probable Water/Wastewater cost range is \$80 to \$90 million

CL01007

LEGEND:

- 30" ZONE 1 SYSTEM
RESERVOIR, WELL AND PIPELINE
- 20" ZONE 2 SYSTEM
RESERVOIR, WELL AND PIPELINE
- 12" ZONE 3 SYSTEM
RESERVOIR, WELL AND PIPELINE
- 12" ZONE 4 SYSTEM RESERVOIR,
WELL AND PIPELINE, UPPER ZONE BOOSTER
- 12" UPPERZONE SYSTEM ZONES 5-10
RESERVOIR AND PIPELINE
- WHITE HILLS BOUNDARY
- PRESSURE ZONE BOUNDARY
- EXISTING WELLS
- W 2005 TEST WELLS

